Boatwright and Seekins (2011)

$\Delta \sigma = 419 \text{ bars}$

- Point source Brune model requires elevated stress parameter and corner frequency to match the level of Saguenay observations
- Noticeable deficiencies remain
- Poor azimuthal coverage of observations, most sites to SE

The Saguenay Quandary
Can full waveform finite-fault simulations shed any light?

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All motions empirically adjusted to $V_{s30}=1000 \text{ m/s}$

Elevated motions at St. Lawrence sites over broad frequency range
Simulating Haddon-like Rupture
(based on Haddon, 1995)

- Full theoretical radiation pattern and GFs across all frequencies – **no stochastic elements**
- Standard SCR $M_o$-Area (Leonard, 2010)
- Hypocenter at northwest end of fault
- Smooth slip distribution with systematic increase in slip away from hypocenter
- Constant rupture speed at 95% of $V_s$
- Impulsive slip-rate function (truncated crack model)
- Very short slip duration, truncated at $T_D=0.2$ sec
- No scattering

BBP Simulation with Modified GP14.3 Method

- Full theoretical radiation pattern and GFs for $f<1$ Hz
- Semi-stochastic approach for $f>1$ Hz
- Same fault dimensions/geometry as Haddon-like
- Smoothly varying randomized slip distribution
- Variable rupture speed with average at 95% of $V_s$
- Decrease slip duration by 34% relative to standard ENA (average slip duration of 0.3 sec)
- Increase corner frequency by 34% relative to standard ENA
Some thoughts …

- Stochastic models (both point source and finite-fault) cannot match all the important features of Saguenay motions
- Full waveform finite-fault models can better match some of these features, but the more optimized these models are, the less predictive capability they have
- Requires at a minimum, elevated corner frequency (short rise time) and fast rupture speed
- May have, but does not require, elevated static stress drop (e.g., Hartzell et al., 1994)
- Rupture directivity to the SE appears to be important
- Are we overlooking something-
  - Site response?
  - 2D / 3D path effects?
  - Other?

References


